FTSE/JSE Index Migration: Testing for the Index Effect in Stocks Entering and Exiting the Top 40

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FTSE/JSE Index Migration: Testing for the Index Effect in Stocks Entering and Exiting the Top 40

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Abstract

This paper seeks to uncover whether periodic changes to the constituents in the Top 40 index lead to price distortions during quarterly index rebalancing. The premise for this research follows from the notable increase in assets under management of index tracker funds both globally and locally, in recent years. A larger asset base tracking a given index would imply larger volumes of forced buying and selling by passive tracker funds when changes are made to the constituents underlying the index. This follows as the passive trackers are tracking error sensitive as opposed to being price sensitive, which should lead to predictable excesses in demand for stocks entering and supply of stocks exiting the index. The objective of this research is to uncover whether these dynamics result in price distortions in the local index, and in particular whether it can be profitably exploited by front-running anticipated changes. Our study indeed confirms the existence of a highly profitable index effect, conditional upon timing trading actions correctly and being able to accurately predict entrants and deletions ahead of the public announcement.

Keywords: Index front-running, passive rebalancing trade

JEL classification G11, G14

1. Introduction

In this paper we test for the existence, or otherwise, of an Index Effect for stocks either entering or exiting the FTSE/JSE Top 40 benchmark index. The premise for our study follows from the notable increase in assets under management of passive funds in South Africa in recent years. A natural question then is whether there exists a distortive pricing effect on dates where passives rebalance. For the Top 40, the rebalancing date is preceded by nearly two weeks of public knowledge on the constituents entering and exiting the index, following a week of the market's ability to calculate the same. As the large and growing passive indexation space can be considered more, or arguably exclusively, sensitive to tracking error rather than prices, nearly all of this "forced" trading would have to be completed on the first trading day before changes to the index become effective.

This obvious quirk of a large simultaneous constituent adjustment of the Top 40 is not unique (in fact, it is common for other indices too, see for example Green and Jame (2011) & Petajisto (2009)). Rather, the clearly communicated

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and timeous nature of the details of locally rebalanced constituents that are known well in advance is more unique. This contrasts to, for example, the rebalancing of the S&P500, where the market does not have as clear an indication ahead of time of the possible constituent adjustments. This should *intuitively* produce a consistent opportunity for those that could front-run the index to earn arbitrage profits[1].

Our findings, however, suggest that the local market has become increasingly efficient at smoothing this constituent transition from the date of announcement. This is similar to the findings of Chen, Noronha, and Singal (2004), who showed that the S&P 500 Index Effect was significantly reduced following the announcement of index changes ahead of the rebalancing date. Index Effect opportunities do still exist, however, if one could correctly predict the additions and deletions in advance of it being made public. In this paper, we outline several possible profitable strategies and detail the timing for how they could be implemented.

In theory, the reduced opportunity to profit off a predictable and simultaneous trade on rebalancing is to be expected. This follows as there is no fundamental change in the value of the underlying stock entering or exiting an index, and as such the pricing schedule should remain unchanged. It is, however, less clear whether there could exist some fundamental medium term after-glow (or post-depression) effect for stocks entering (exiting) a large index.[2] This is also tested by comparing the volume traded, excess returns and standard deviations of stocks for the 6 and 12 months preceding and following rebalancing. We find, somewhat surprisingly, that both additions and deletions generally tend to *underperform* relative to the Top 40 Index after the rebalancing date (although this could be attributed to a size effect, as suggested by comparable performances in line with the equally weighted returns of positions 30 - 40). We also find no clear discernible change in volatility, but do find that trading volumes are significantly higher (lower) for stocks entering (exiting) following rebalancing.

The paper is structured as follows: we first discuss the official time lines for communicating changes to the index by the constituent providers in section 2. This is followed by a demonstration of the relevance of our study in section 3 by considering the aggregate daily volume traded of stocks entering or exiting the index on the rebalancing date, showing a clear and significant spike in trade on said days. This underscores the sizable impact that the "forced" rebalancing trade of passive funds have on these stocks. In section 3.1 and 3.2 we discuss existing theories possibly explaining such events, and ground our findings in the existing literature. Section 4 gives an overview of the methodology used in constructing the trading signals to determine whether the index effect exists. We consider whether the rebalancing effect is translated into predictable price distortions, or whether the market is efficient at pricing in these events in section 5 and 6. We finally consider whether there are any longer term effects on rebalanced stocks over a 6 and 12 month post rebalancing horizon in section 7. This is followed by our concluding remarks in section 8.

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[1] Index front-running in anticipation of rebalancing could be done by buying up future additions in anticipation of the high future demand from passive index fund managers, or selling short deletions in anticipation of a future sell-off.

[2] This could be due to, e.g., a company gaining some prestige value for being in an index, with possibly easier and cheaper access to funding or higher demand for stock holdings.

2. Data

Our data spans from December 2002 to March 2018, and includes all the stocks that were part of the FTSE/JSE Top 40 Index during this period. It is a carefully compiled set that includes the relevant market capitalization and free-float information available to the market at each date in the past, with total returns considered throughout. We also control for the effect of corporate actions, stock splits and other possibly distorting price effects. The index is reviewed every three months in March, June, September and December and includes the 40 most investable companies, as determined by the float-adjusted market capitalization[3]. Since December 2002, there have been 55 additions to and 54 deletions from the FTSE/JSE Top 40 Index on review months.[4]

The index providers have put measures in place to prevent the index from behaving like a revolving door for companies close to the cut-off threshold. A share that is not yet in the index will enter if it rises to position 35 or above, while a share that is in the index will drop out if it falls to position 46 or below. If a non-constituent rises to position 35 or above and no constituents rank below 46 the non-constituent will still enter and the lowest ranking constituent will be removed. The same applies to deletions. If there are changes to the index (which does not happen every rebalancing date, as seen for example by only one rebalancing during 2004 - 2005), rebalancing takes place at the close of business on the third Friday of the index review month. The changes are effective on the first business day after the third Friday.

There are several important dates, known in advance, to which index providers adhere in order to provide transparency to the rebalancing process. Below follows an abbreviated time line of this process:

- The *ranking cut date* (RCD) represents the date on which closing prices and indicative free floats are used to rank the universe of stocks. This takes place four weeks prior to the effective date and is thus labelled the "calculation" date, which is generally 19 trading days before the official rebalancing date ($t - 19$).

- The official *announcement date* (AD) of changes takes place on the Wednesday before the first Friday of the review month. This is generally 12 trading days before the official rebalancing date ($t - 12$).

The announcement date, however, has not been consistent across our sample, with the JSE issuing a notice in January 2014 detailing changes to the ground rules. The announcement date was moved from the Wednesday after the first Friday of the review month to the Wednesday before the first Friday of the review month, effective from March 2014. Prior to this change, the announcement date fell 7 days before rebalancing, with the rank-cut

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[3]Prior to September 2016 the universe was ranked by total market capitalization. In June 2016 the JSE issued a notice detailing changes to the ground rules stipulating that the Top 40 index universe will be ranked by floating market capitalization from the September 2016 rebalance onwards.

[4]The sample of deletions was trimmed to 54 constituents due to the double listing of Coronation; the ticker CRH SJ Equity is included and CRN SJ Equity is excluded.

(calculation) date 12 days before. In order to account for these changes we split the sample into two groups: changes that occurred between December 2002 and December 2013, and changes thereafter. Period 1 consists of 30 additions and 29 deletions and period 2 consists of 25 additions and 25 deletions.

For a full list of addition and deletion constituents and their dates of entry and exit from the index, see tables 1 and 2 in the appendix. Also note, we do not consider listings (delistings) as additions (deletions) in our event study. To get a sense of the turnover of the Top 40 Index, consider Figure 1 below. It shows the number of additions and deletions on each rebalancing month.
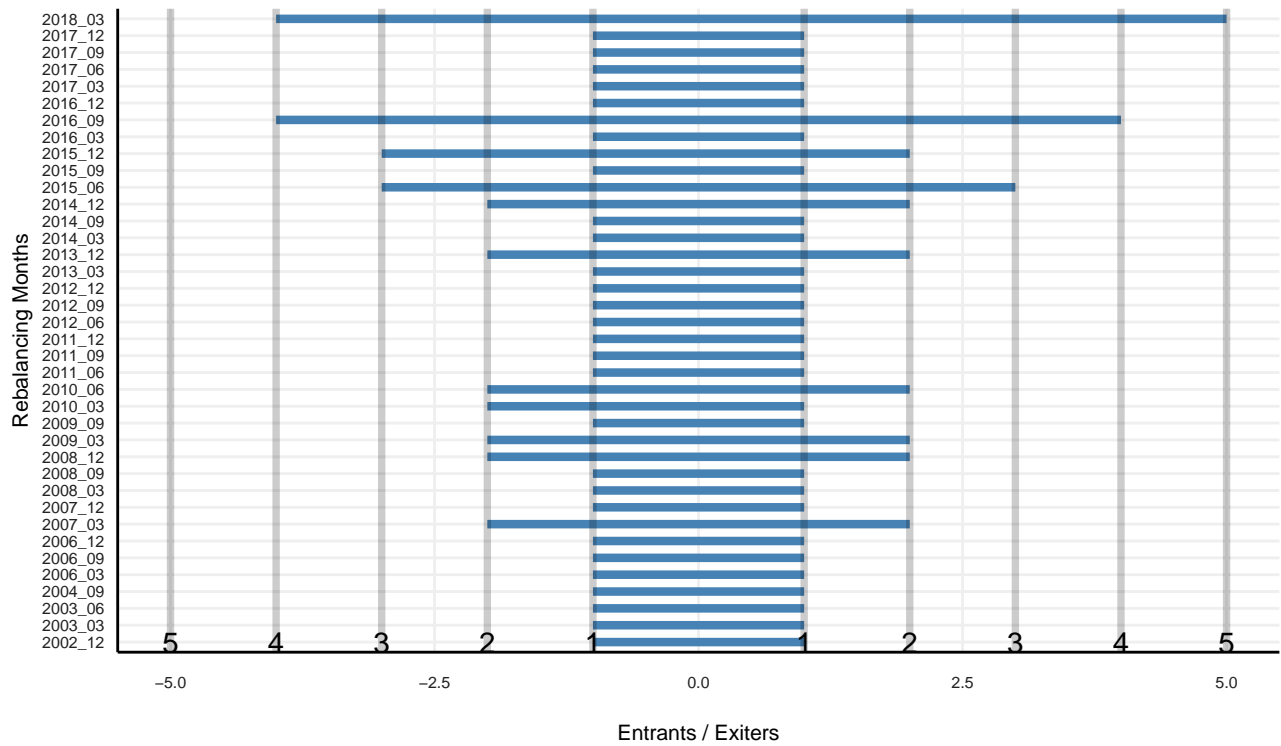

Figure 1: *Number of Additions and Deletions for each rebalancing month*

From Figure 1, we see that rebalancing is mostly limited to one or two stocks entering and exiting. In terms of the longevity of constituents that enter, the index provider seeks to ensure a stable and predictable set of constituents making up the index (avoiding a revolving door process of frequent rebalancing). There are, however, isolated instances where stocks enter (exit) and subsequently exit (enter) after a short period (for example, within a single quarter), but these are the exception and not the rule. This can be seen in Figure 2, which shows all the companies that have been in the Top 40 index since 2002. The stocks are ranked by their total contribution to the index weight over time, with a deep red color indicating a higher weight in the index (opposite for green). It is clear that one-time entrants are exceptions rather than the rule, with most additions or deletions spending prolonged periods in (or out of) the index.
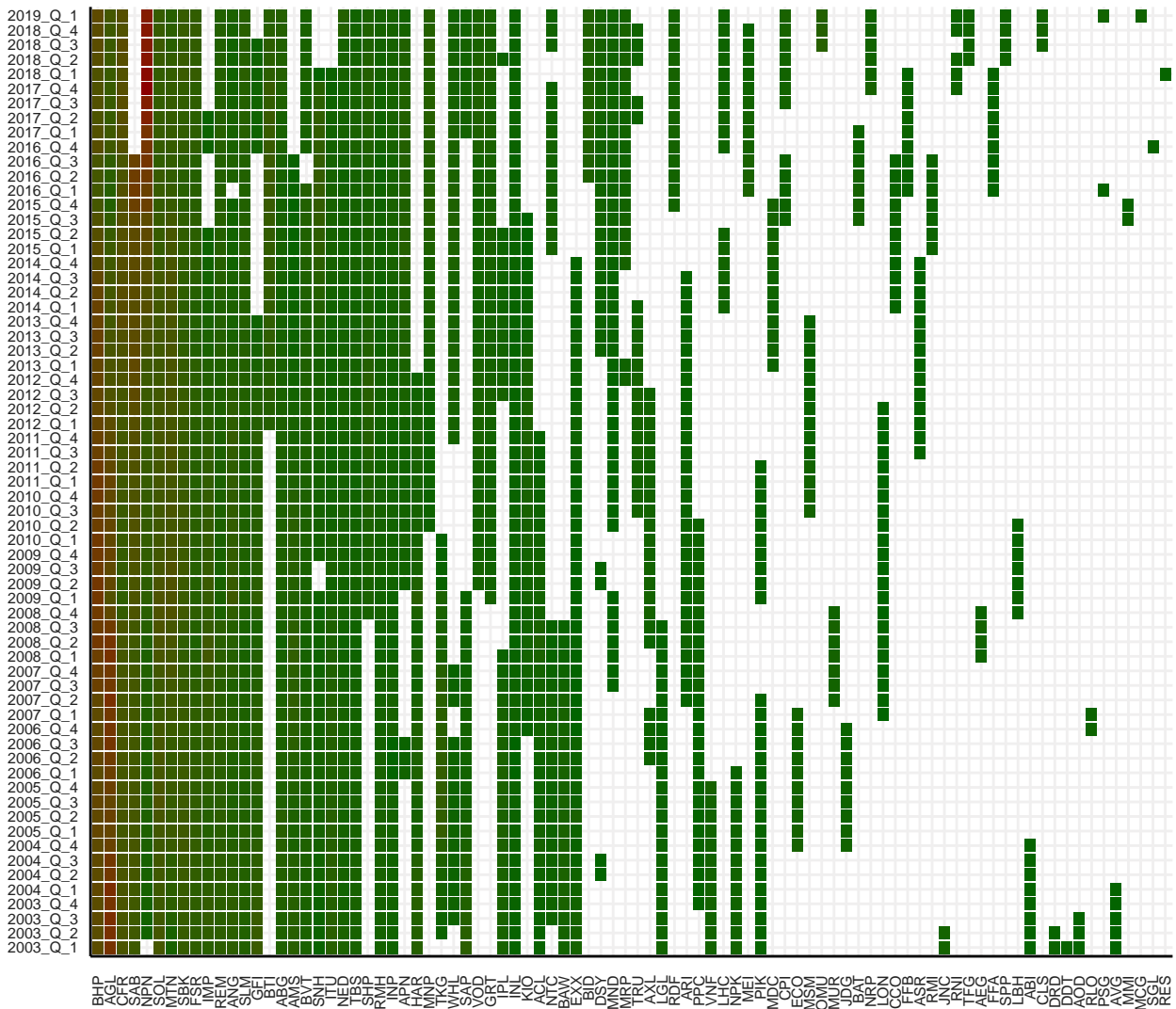
Figure 2: *Time Spent in Top 40 Index*

3. Do passives really turn up the volume?

As discussed in the introductory section, the size of the passive industry and its tracking-sensitive, price-insensitive nature should, by construction, lead to predictably high volumes of trade for stocks entering or exiting the index the first trading day before changes become effective. The incentive for passive index trackers to smooth their buying (selling) of additions (deletions) is trumped by their mandate to minimize tracking error.[5] These volume spikes are

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[5]Theoretically, a passive index tracker should be indifferent to price distortions created by such predictably high trade, as it would not affect its index tracking error once settled. For the sake of brevity, we omit a deeper discussion here of the full incentive structure faced by passive index trackers, where cost minimization using some form of improved intra-day trading would, naturally, be a key

clearly visible in Figure 3 below, depicting the distributions of addition and deletion constituents' volume divided by each constituents' 60 day moving average. We show a boxplot with the volumes for the 19 days preceding $(t-19)$ and five days following $(t+5)$ the Rebalancing. As mentioned earlier, most of the rebalancing trade for the Top 40 takes place the Friday before the Effective Date, to minimize possible tracking error. We will forthwith refer to this date as the Rebalancing Date (RD), or $t=0$. The volumes traded on this day are significantly higher for stocks affected by rebalancing and are on aggregate between 4 to 6 times more than the 60 day MA. This is despite the high volumes typically traded on the day before (the Thursday) as a result of options close-out. The $t=0$ rebalancing stock volumes are in contrast to the rest of the market's more muted trading activity on the Friday, albeit with some residual trade following Thursday close-out and the rebalancing effect[6].
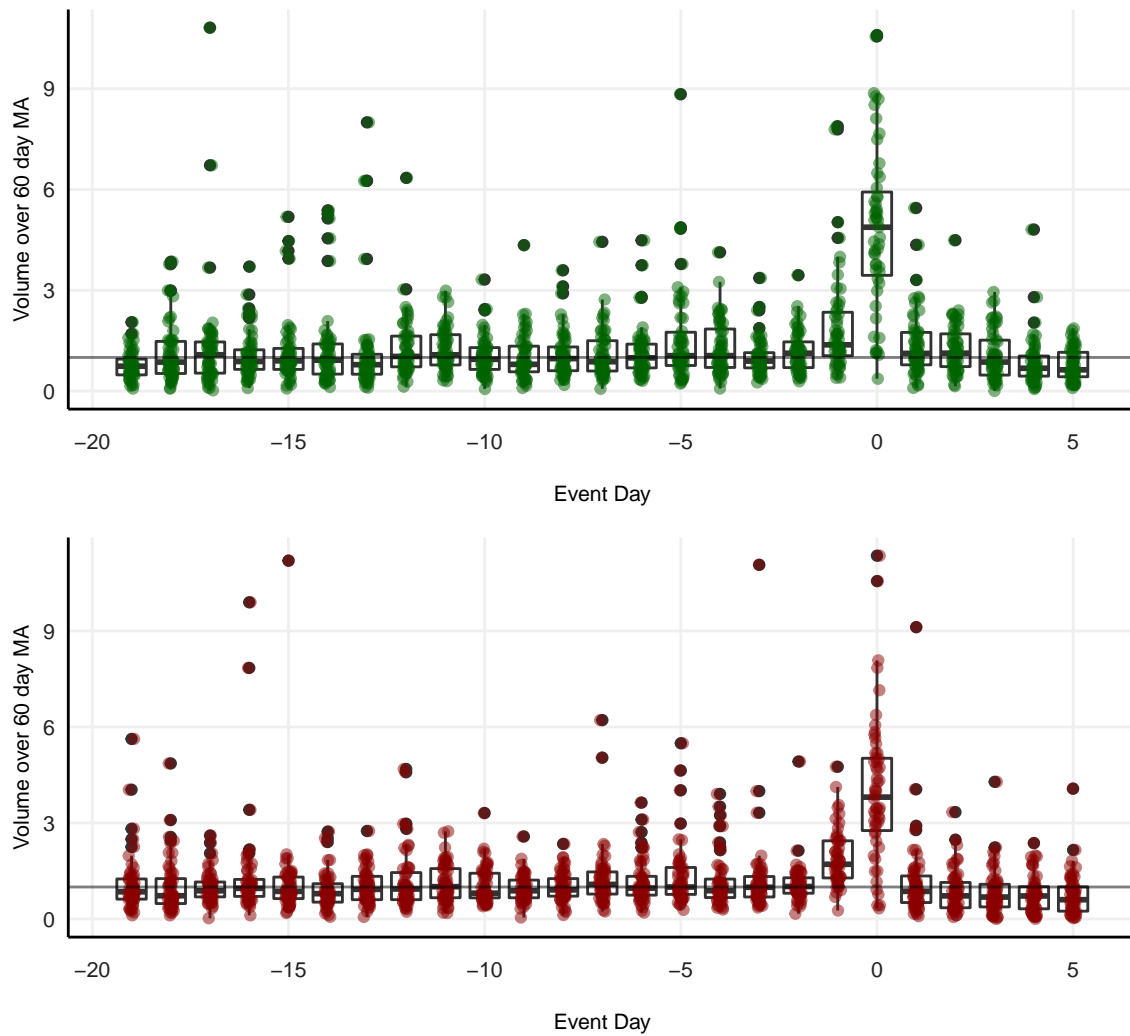

Figure 3: *Addition (green) and Deletion (red) volumes divided by 60 day moving average*

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consideration too. Interested readers can refer to Kappou, Brooks, and Ward (2010a) for a detailed study on said incentives, as applied to S&P500 index trackers.

[6]Refer to Figure 12 in the appendix.

3.1. The theoretic impact of a predictable spike in demand

Standard economic theory suggests: excess demand (supply) should lead to higher (lower) prices, all things equal. This simplistic statement, regardless of its intuitive appeal, fails to account for the reasoning behind, and predictability of, the increased demand / supply. In particular, it fails to convey whether it is a movement *along* or *of* the demand or supply curves. If the former (along), we should expect abrupt price changes to be followed by an opposite and equal correction to the previous "fundamental" level of the supply and demand intersection (c.f. Petajisto (2009) for a richer discussion into the relevance of demand slopes in the present context). In finance parlance, if a stock has a constant fundamental value, a sudden price change should be followed by the opposite pricing pressure, *ceteris paribus*.[7] There is little reason to believe that once a stock enters an index, it has undergone a fundamental change (or a shifting *of* the demand curve). Notwithstanding, various studies do provide evidence of a permanent (or structural) price increase following inclusion into an index (e.g. Shleifer (1986), Platikanova (2008), Chen, Noronha, and Singal (2004) & Liu (2011)). We will test the voracity of these findings in the South African context by seeing whether there is an after-glow effect (see section 7), but for now we assume stocks remain fundamentally the same for the short term (immediately after rebalancing).

Also easily ignored from our earlier simplistic demand / supply statement is whether the market displays the ability to anticipate certain events and adjust behaviour accordingly. In the presence of perfect expectations with full information (strongly efficient markets), we would expect the price adjustment (if nothing has fundamentally changed) to be infinitely quick, with the large $t = 0$ volume spike we saw earlier to be accompanied by no noticeable return spike. In theory, this would imply index front-runners buying up additions (selling deletions) in anticipation of meeting the large demand (supply) from passive index providers on rebalancing.

Unfortunately, as rebalancing rules differ, a true counter-factual to our limited data sample is not possible. For the S&P500, for example, on which various studies have been applied (see, *inter-alia* Gowri Shankar and Miller (2006), Green and Jame (2011), Petajisto (2011), Chen, Noronha, and Singal (2004), Platikanova (2008) & Jain (1987)), changes are not governed by an equally clear and transparent set of ranking criteria (Kappou, Brooks, and Ward (2010b, 117)), making the comparison less relevant. Nonetheless, the literature does provide some interesting findings and theories to place our own experience into context.

The *imperfect substitutes hypothesis* posits that stocks added to an index do not have perfect substitutes. As such, Shleifer (1986) argues that the downward sloping nature of stocks' demand curves (as opposed to horizontal) implies a rightward shift due to higher demand from index-linked funds, permanently increasing the price of additions. Harris and Gurel (1986) argue for the existence of a *price pressure effect*, where the large simultaneous rebalancing of passive index-linked funds cause a temporary price squeeze for rebalancing stocks. In particular, investors able

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[7]While it may take an uncertain amount of time to adjust, it should at the very least not be a profitable strategy to pursue if it is simply a temporary movement along the curve.

to supply additions (buy deletions) on the rebalancing date are found to earn a premium for doing so. This effect is argued to be temporary, with a price correction expected to follow (as, for example, suggested by Gowri Shankar and Miller (2006)).

The *information hypothesis* was initially proposed by Jain (1987) and suggests that the addition of stocks to indices may convey positive information about a company. Such information, which includes likely future stability, quality of management or perceived reduced risk, is argued to provide a permanent boost to the valuation of entering constituents. It is argued that market participants could, for example, trust that index providers such as Standard and Poors face reputational risk in ensuring additions are worthy of joining the prestigious S&P500 list. Various studies, including Denis et al. (2003) and Platikanova (2008), find evidence of positive information effects underpinning permanent positive price adjustments.

Another hypothesis proposed is the *liquidity hypothesis*, which posits that stocks added to a large and well tracked index provides liquidity benefits to its constituents. This, in turn, is rewarded by investors who view such stocks as seemingly safer investments with comparatively lower transaction costs. Readers interested in a more comprehensive comparison of these competing theories should consult Chen (2006), who shows that the imperfect substitutes hypothesis explains the majority of the rebalancing effect found to exist in the Russel 1000 index. Various other theories (including, for example, Chen, Noronha, and Singal (2004) who argue that greater investor awareness leads to a permanent price increase for entering stocks) have been suggested, but we omit a deeper discussion here for the sake of brevity.

3.2. Event Studies

The testing of these theories have generally been conducted using event studies that propose some form of a market model. Gowri Shankar and Miller (2006) and Mase (2007), for example, fit a simple single factor (CAPM) model to calculate abnormal returns in excess of the fair (market) returns. These fair value estimates are, in turn, based on return comparisons between one month and twelve months after rebalancing. These estimates are then used to test for price reversals for a defined window period overlapping the rebalancing date. Kruger and Toerien (2013) followed a similar methodology applied to South Africa, testing for significant price reversals following Top 40 Index rebalancing. They find reversals in abnormal returns over specified event periods, consistent with a short-term price adjustment that was evidently self-correcting.

Miller and Ward (2015) expanded on this by considering a 12-factor market model to create their version of abnormal returns (CARs) for constituents affected by rebalancing (their event study methodology mirrors that of Ward and Muller (2010), albeit applied in a different context). Miller and Ward (2015) also consider the FTSE/JSE Top 40 Index, the FTSE/JSE RAFI 40 index, the FTSE/JSE Resources 20 index and the FTSE/JSE Financial and Industrial 30 index. Similar to Kruger and Toerien (2013), abnormal returns are calculated by subtracting the

expected return (based on their 12 factor market model) from the return of each company affected by rebalancing.

Notwithstanding the impact of non-overlapping data in estimating such market model values, the accuracy and relevance of these event studies can indeed be questioned.[8] It seems that a more intuitive approach to answering whether there exists a significant rebalancing price distortion, would be to consider returns in excess of the tracked benchmark (as, for example, used by Chen, Noronha, and Singal (2004)). This follows as significant price distortions are also, all things being equal, expected to be reflected in aggregate excess returns. It also has the benefit of providing practitioners with a means of assessing whether a profitable long-short trading signal is present, a practical application sorely lacking from the abstract interpretation of deviations from an estimated market model.

We will also consider the medium term impact on aggregate volumes traded and realized volatilities of Top 40 stocks affected by rebalancing. Liu (2011) makes use of a multivariate regression framework and finds that additions experienced heightened levels of volatility when entering the Nikkei 225. This is contrary to most other studies that find muted levels of volatility for other indices. Chen, Noronha, and Singal (2004) also echo earlier findings from Harris and Gurel (1986), that volumes only modestly increase following index inclusion. Both of these measures (volume and volatility) will be tested for rebalancing companies in section 7.

4. Methodology

We adopt an event study methodology where we set each rebalancing date in the past equal to $t = 0$ and consider the returns and volumes traded for 19 trading days preceeding and 5 trading days subsequent to $t = 0$. First we test whether periodic passive rebalancing results in short-term price distortions by examining the excess returns of additions and deletions on $t-1$, $t = 0$ and $t+1$. Thereafter, we test for the existence of an index effect by calculating the returns of 3 different trading signals for two holding periods, demonstrating that the success of these strategies relies on acting before official changes are communicated to the market. First, we consider the period from the official announcement ($t - 7$ before 2014 and $t - 12$ after) to the RD ($t = 0$). Thereafter, we test for the dates from when the changes could have been predicted with a reasonable degree of certainty (the RCD, $t - 12$ before 2014 and $t - 19$ after), while exiting the strategy before the RD (set a week before rebalancing). The strategies are rand-neutral implying that the short positions fund the long positions and consist of the following: long additions and short deletions, long additions and short the market (J200) and long the market and short deletions. We ignore all transaction costs as well as interest earned on margin in our return calculations.

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[8]We omit a deeper discussion into the accuracy of market models and linear stability of estimated betas when estimating a fair value return, but do note that this approach opens itself up to various specification issues as applied to the current context.

5. Short-Term Price Distortions

In this section we consider the distribution of excess total returns (relative to the Top 40 Index) of additions and deletions at $t-1$, $t=0$ and $t+1$. We address the question raised earlier: does the predictable and significant spike in demand for additions and supply of deletions on the rebalancing date cause equally predictable price distortions? If we posit that markets in South Africa are highly efficient, then the public and orderly communication of rebalancing of the Top 40 should lead to a smooth pricing transition. We find, somewhat surprisingly, that the heightened volumes on the RD are accompanied by the *opposite* effect to what we would intuitively expect.

Figures 4 and 5 show the densities of the excess returns of additions and deletions on, before and after the RD. The text on the plots show the percentage of constituents that had positive excess returns from the previous day's close to the close of the specified day. It also shows the p-values from a Wilcoxon rank sum test, which is a non-parametric test applied to the hypothesis that the additions (deletions) have a higher (lower) return distribution than the market on each rebalancing day (see Section 9.1 in the appendix for details). The solid black line is the median. The second set of figures for each show the absolute returns of each addition and deletion on event day -1, 0 and 1, respectively.
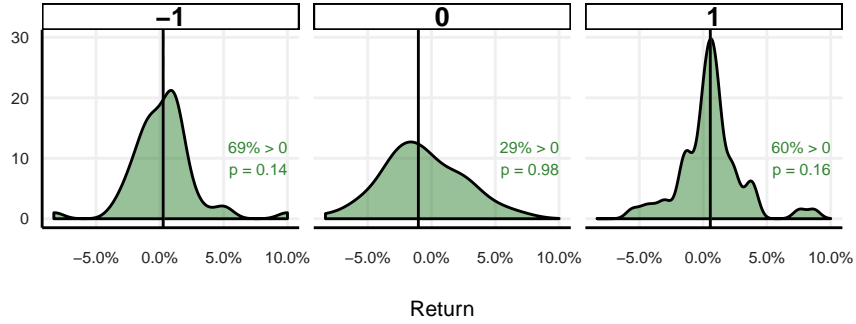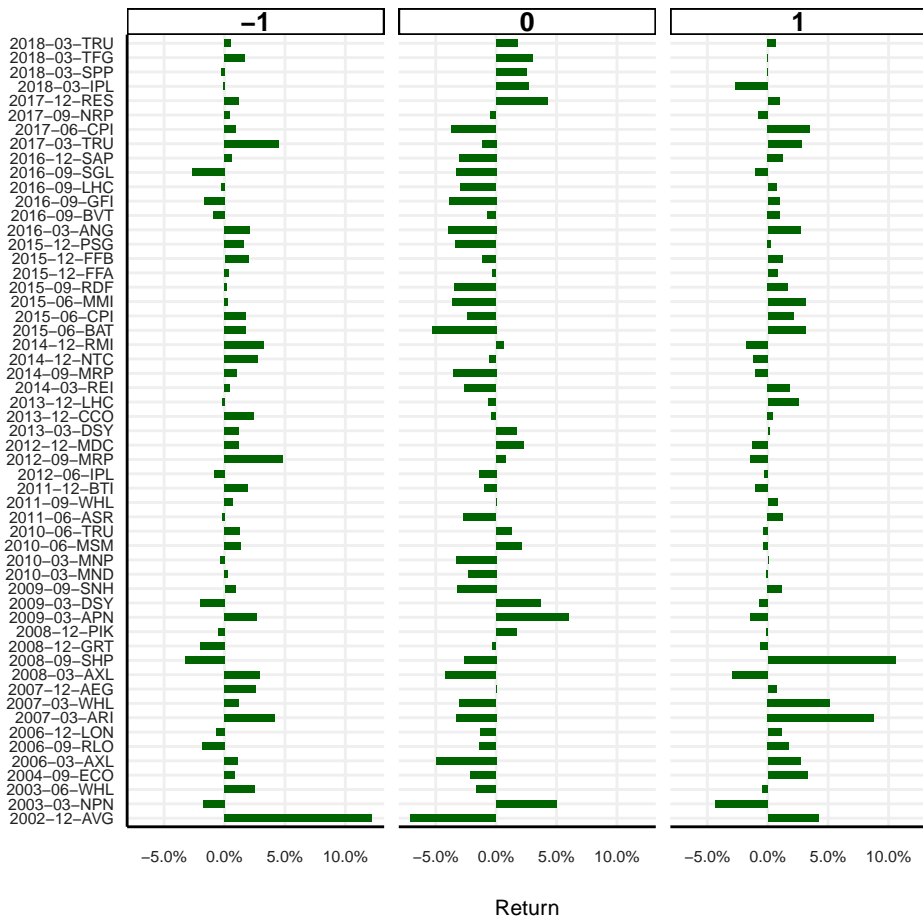
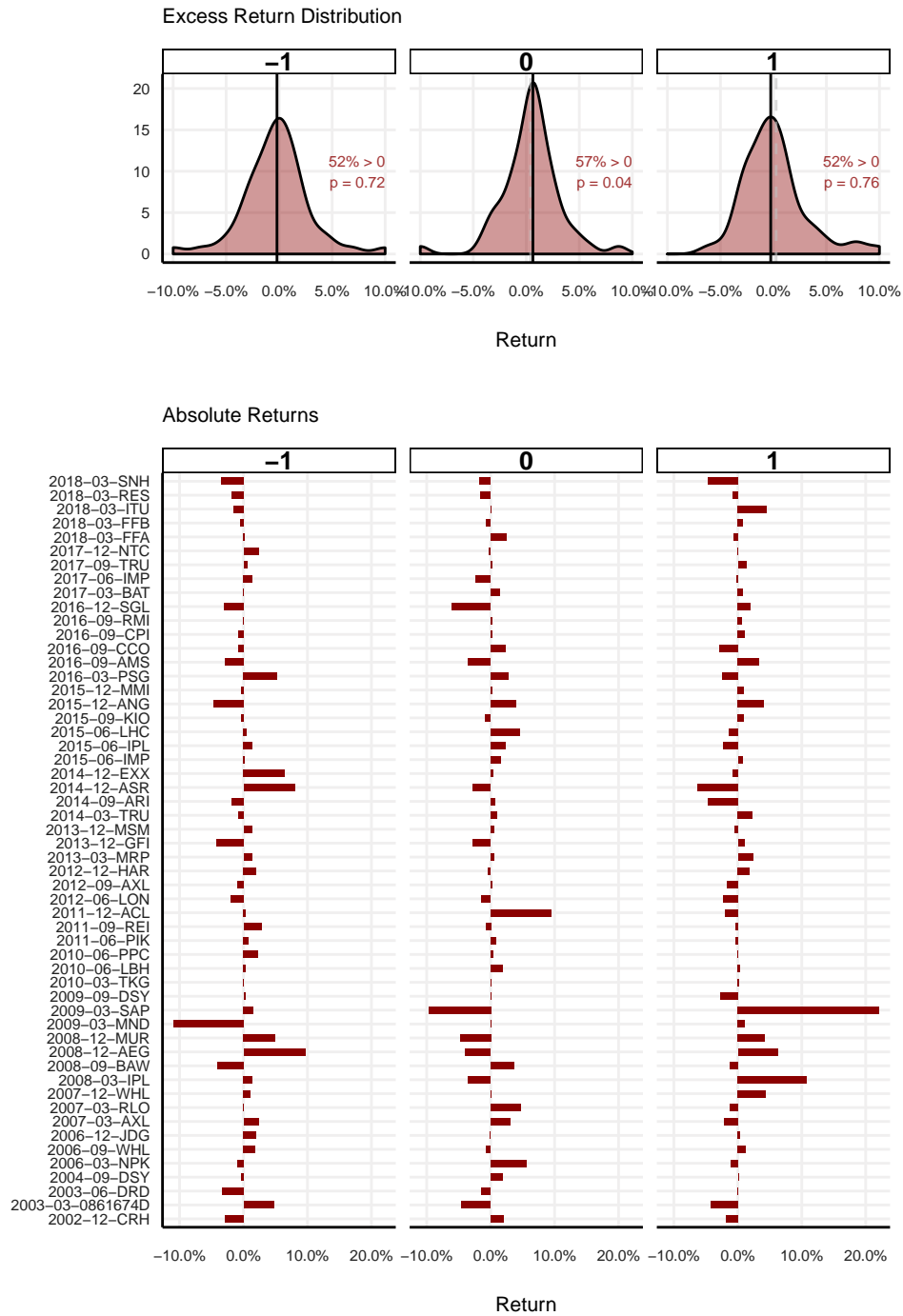**Figure 4:** *Addition Excess Return Distributions and Absolute Returns*

Figure 5: *Deletion Excess Return Distributions and Absolute Returns*

From the figures above, it is interesting to note that on the day of the high volume spike ($t = 0$), most of the stocks closed lower (higher) than the market for additions (deletions). This is counter to our intuitive theoretic statement that higher demand (supply) on $t = 0$ should see higher (lower) prices. For more details on the exact entry and

exit dates, refer to Tables 1 and 2 in the appendix[9].

At face value, it seems odd that the high volume following from the demand for additions from passive funds are not leading to a (even temporary) spike in prices relative to the market. It seems as though the high demand is met with a build-up of supply from index front-runners that, on aggregate, overshoot the actual amount volume required, leading to a counter-intuitive decrease in returns. We will be exploring this by expanding the date ranges to immediately after the rank-cut (calculation) date to just before and on the RD next.

6. Testing for an Index Effect

Below we plot the returns of the 3 strategies for the 2 different holding periods.
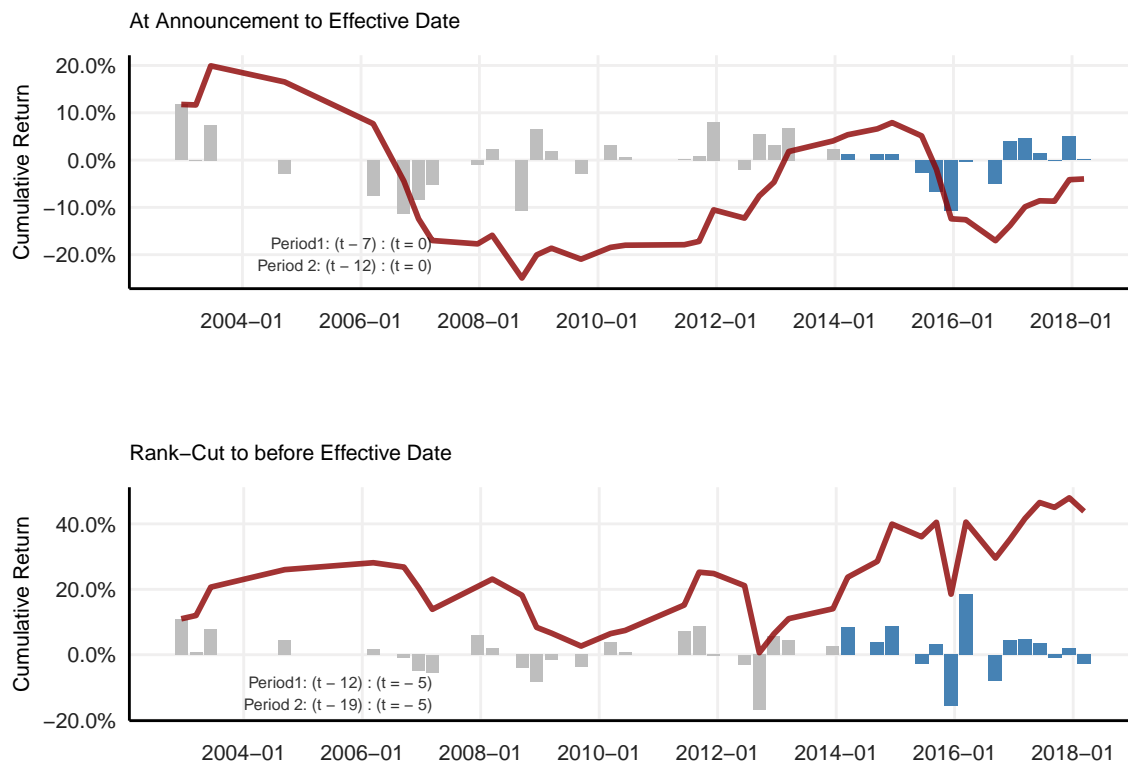

Figure 6: *Long Addition Short Market Returns*

Figure 6 suggests that there is no trading strategy for buying additions on the announcement date and holding it

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[9]The tables also indicate when the Friday before the RD, or the RD itself, fell on a public holiday.

to rebalancing (i.e. front running the index). Market participants that attempt to buy additions in anticipation of the predicable $t = 0$ demand spike tend to underperform the market on aggregate. In contrast, the second figure shows that if one can accurately determine the stocks entering the index at the rank-cut (calculation) date, and exit the strategy a week before the official rebalancing, a strong trading signal emerges over time.[10] Interestingly, this trading signal is strongest in period 2 (where the rank-cut date is further back and the holding period 12 trading days) where the cumulative return over 14 rebalancing periods is just over 25%.

We next consider a long market, short deletion strategy over the same event dates as above.
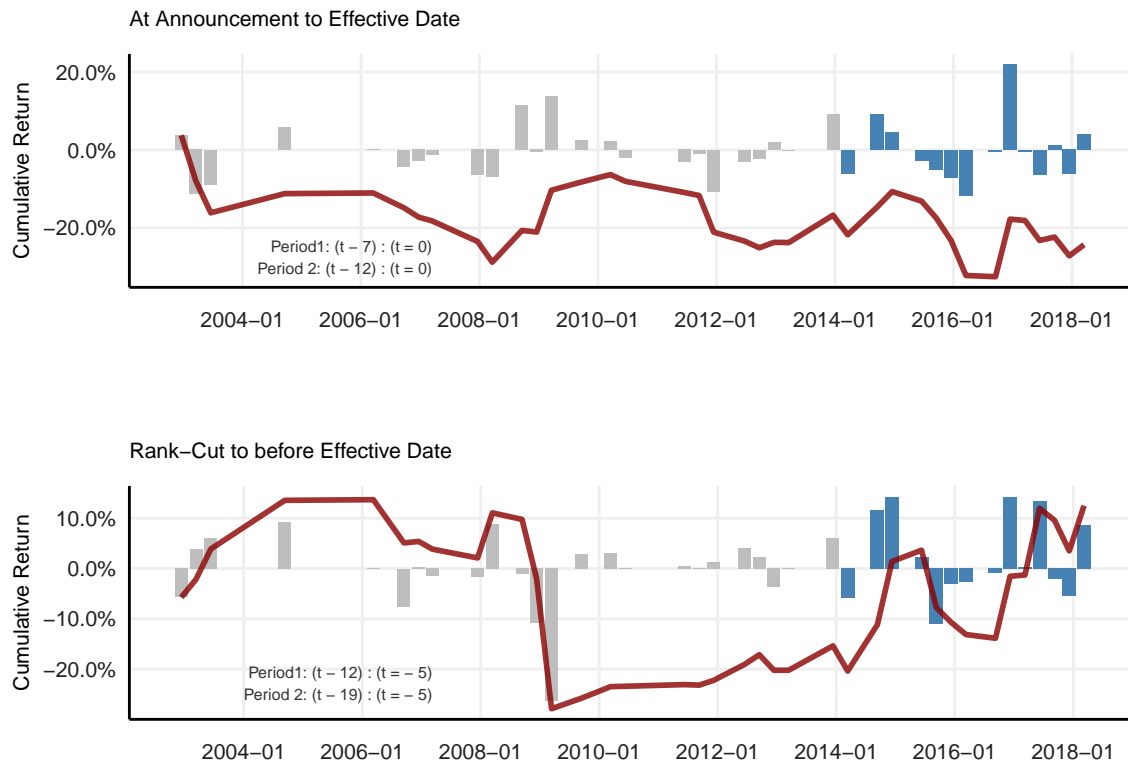

Figure 7: *Long Market Short Deletion Returns*

What stands out from the first figure for deletions above, is that there is no trading strategy for shorting deletions on the announcement date in anticipation of the simultaneous selling of deletions by passives at rebalancing. This is possibly due to the same front-running overshoot effect happening for additions. We again find that there exists a profitable strategy for acting on the rank-cut date ($t - 12$ before 2014 and $t - 19$ after) before the public announcement, and exiting the strategy before the RD. If one can correctly predict which stocks will be deleted in

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[10]Placing this in perspective, a more than 40 percent return difference is experienced over an effective 336 trading dates.

advance, this simple strategy has proven over time to earn a significant market neutral return. In fact, since 2010 this strategy has earned close to 80% return. Over the entire sample period, if one excludes the large loss in March 2009 (when Mondi and Sappi rallied relative to the market, earning 13%, 8% and 8% on three consecutive days), this strategy earned 83% over the whole sample.

We now test the long addition short deletion trading signal. The benefit of this approach is that it gives us a cleaner sense of whether there is indeed a rebalancing effect present, as opposed to it being attributable to, e.g., a size effect. Figure 8 below shows the trading signal of this strategy for the 2 different holding periods.
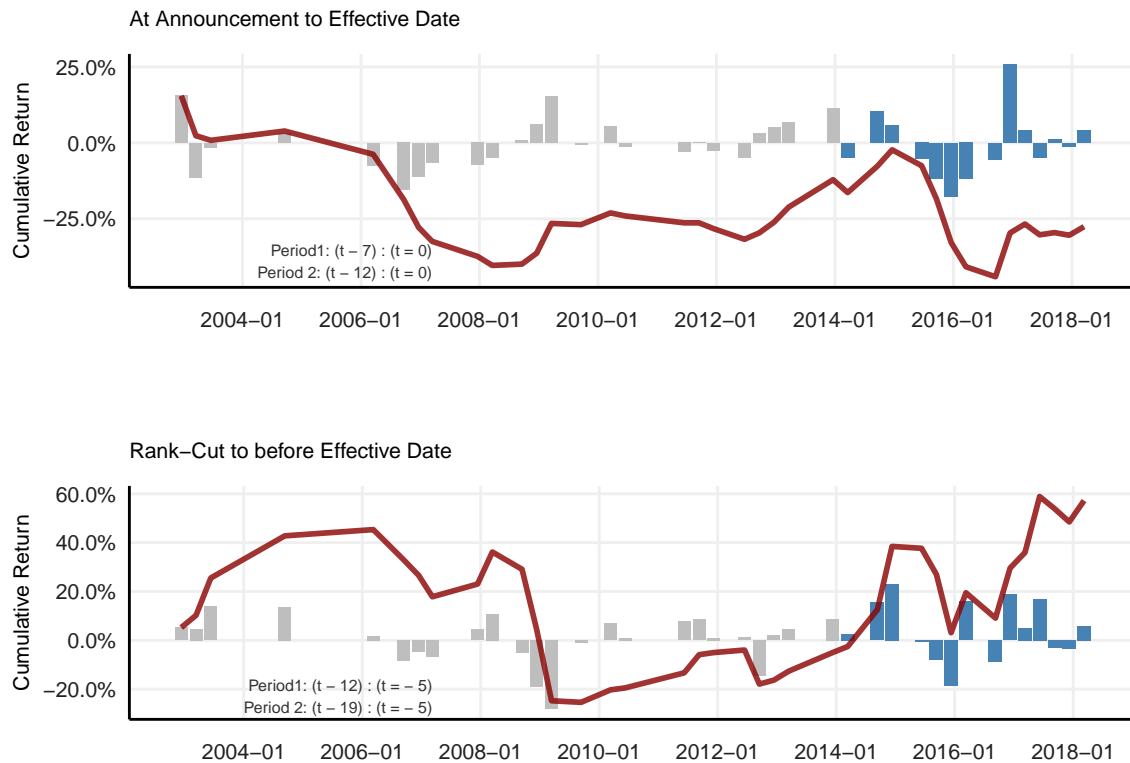
Figure 8: *Long Addition Short Deletion Returns*

Figure 8 confirms what we saw in the previous section, in that a profitable strategy is offered by the index rebalancing effect from reacting before public announcement and exiting the strategy before the front-runners overshoot (as experienced for both additions and deletions). This strategy proves to be profitable and quite consistent over time (an investor would have been in a profitable position with the latter strategy nearly two thirds of the time over the entire sample, and more than 70% of the time after 2010).

In addition to the strategies suggested above, we also look at the return of individual constituents, on aggregate,

for each of the event days, to more clearly see where each of the strategies succeeded or failed. Figure 9 below plots the cumulative median excess returns of the long addition short market and long market short deletion strategies.[11]
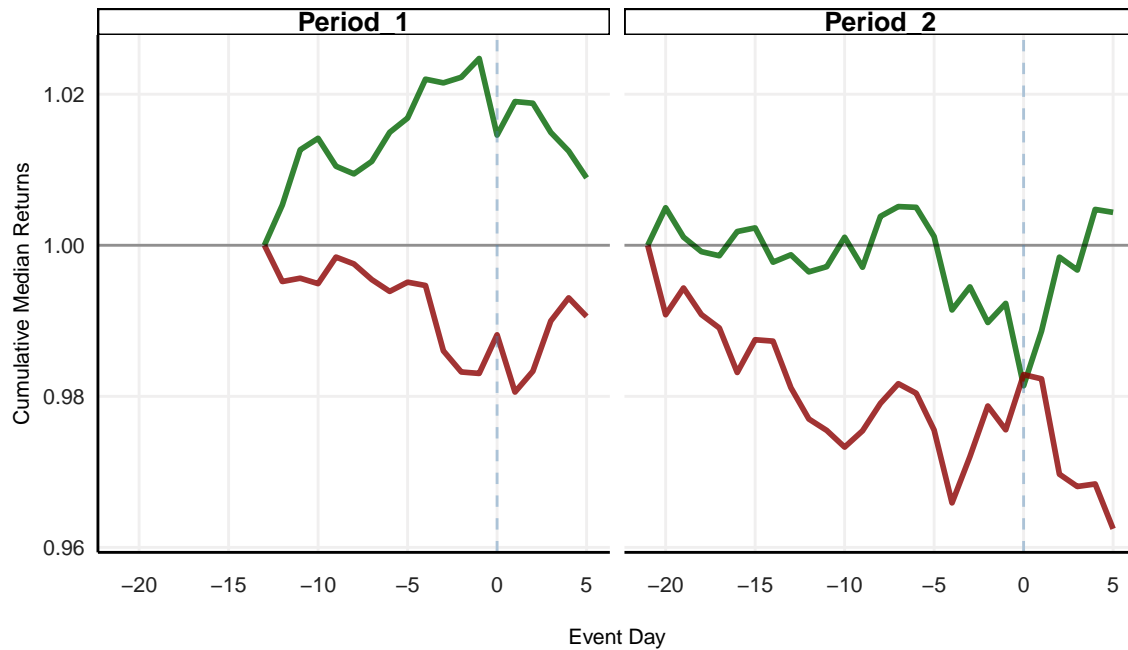

Figure 9: *Cumulative Median Excess Returns of Additions and Deletions*

From Figure 9, we see the expected build-up (decline) of prices for additions (deletions) prior to rebalancing for period 1, before a correction occurs immediately before the RD (consistent with our overshooting hypothesis earlier). It is interesting, however, that in the second period (where the calculation date is moved back further), the excess return signal for additions is much weaker and that of deletions much stronger, when taking the second approach (early entry early exit). The figure clearly shows that for period 2, from announcement $(t - 12)$ to rebalancing $(t = 0)$, deletions on aggregate are flat (as confirmed in the first plot in Figure 7), implying the most reward lies in selling short early, and exiting the strategy early.

We thus conclude from this event study that, for the period since 2014 when the rank-cut and announcement dates were moved back, the market is largely efficient at front-running additions and deletions from the announcement date to the RD (implying by efficiency that there is no discernibly profitable arbitrage trading strategy worth pursuing). We do, however, find a profitable trading strategy exists if one could accurately determine which stocks might enter / exit at the rank-cut (calculation) date, take a long-short position (relative to the market or the other rebalancing stocks) before the official announcement, and exit the strategy a week before rebalancing. This strategy has yielded significant returns, particularly since event dates were moved back in 2014, as evidenced from Figures

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[11]We use medians, as means would be more affected by outliers.

6 to 8. Figure 9, though, suggests that the largest contributor to the LS trading strategy's positive signal comes from shorting the deletions.

The natural question then is whether we could predict stocks entering or exiting at the suggested times. Using the JSE's rebalancing methodologies, we were only twice not able to exactly predict the affected stocks in our sample, implying a well above 90% level of accuracy in prediction.

7. Testing for the Presence of an Afterglow (Post-Depression)

In the preceding sections we explored the efficiency of the market in smoothing the possible short-term price jumps of additions and deletions following a significant spike in demand and supply at rebalancing. In this section, we take a longer term view on the returns, realized volatilities and volume traded of these stocks. Notice that if we roll time back before rebalancing far enough, we do find strongly predictable return patterns for additions and deletions. The interpretation value of this is limited, however, as there exists a clear selection bias as additions (deletions) are expected to have outperformed (under-performed) in the months leading up to their inclusion (exclusion). This knowledge is, in turn, of limited use after the fact, as these stocks would likely not have been predictable *ex ante*. The following figure illustrates this particularly clearly for deletions (the dark solid lines in Figure 10 are regression estimates for the cumulative excess returns). The periods considered below are for 60 trading days before and up to the RD:
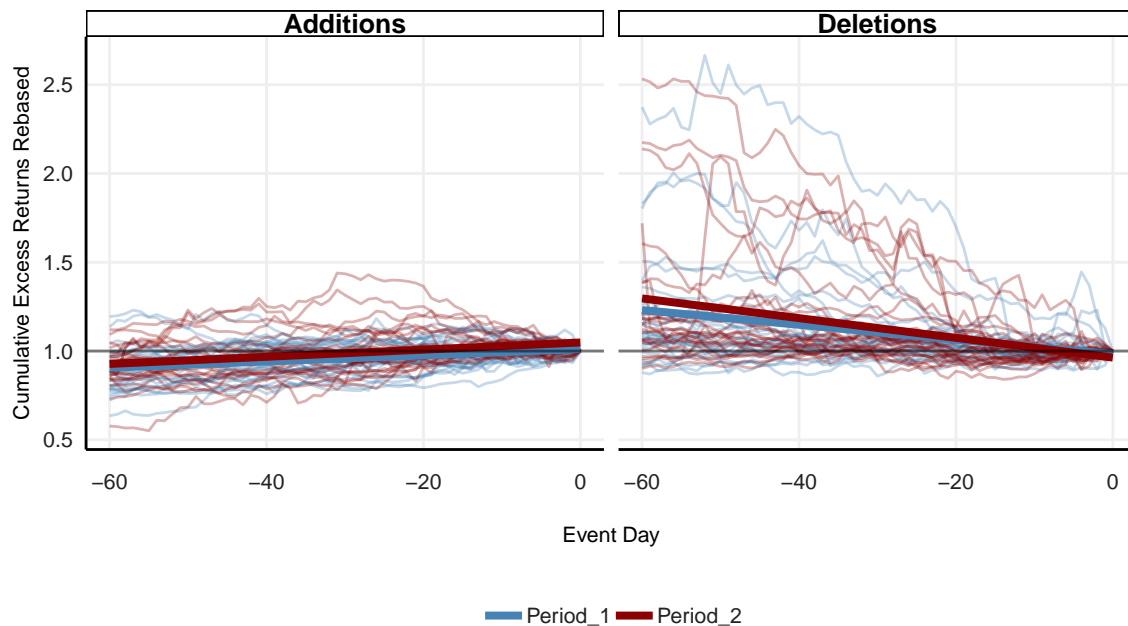
Figure 10: *Addition and Deletion Cumulative Excess Returns Rebased to Event Day 0*

A more sensible approach is to consider whether stocks entering or exiting the index are noticeably different after rebalancing than before (as this would be information that we are able to act upon). To explore this, we include several figures below that show this evolution post rebalancing. We consider four plots comparing the 6 and 12 months pre- and post rebalancing effect for both additions and deletions. First, the excess returns of the relevant stocks relative to their size peers (ranks 30 to 40), and also relative to the Top 40 index, is shown. Next we compare the volatility ratios (realized volatilities) of stocks before and after rebalancing, and lastly we compare each stock's trading volumes before and after rebalancing. For all the figures, we cap the highest ratios at 2 (to have more interpretable scales).
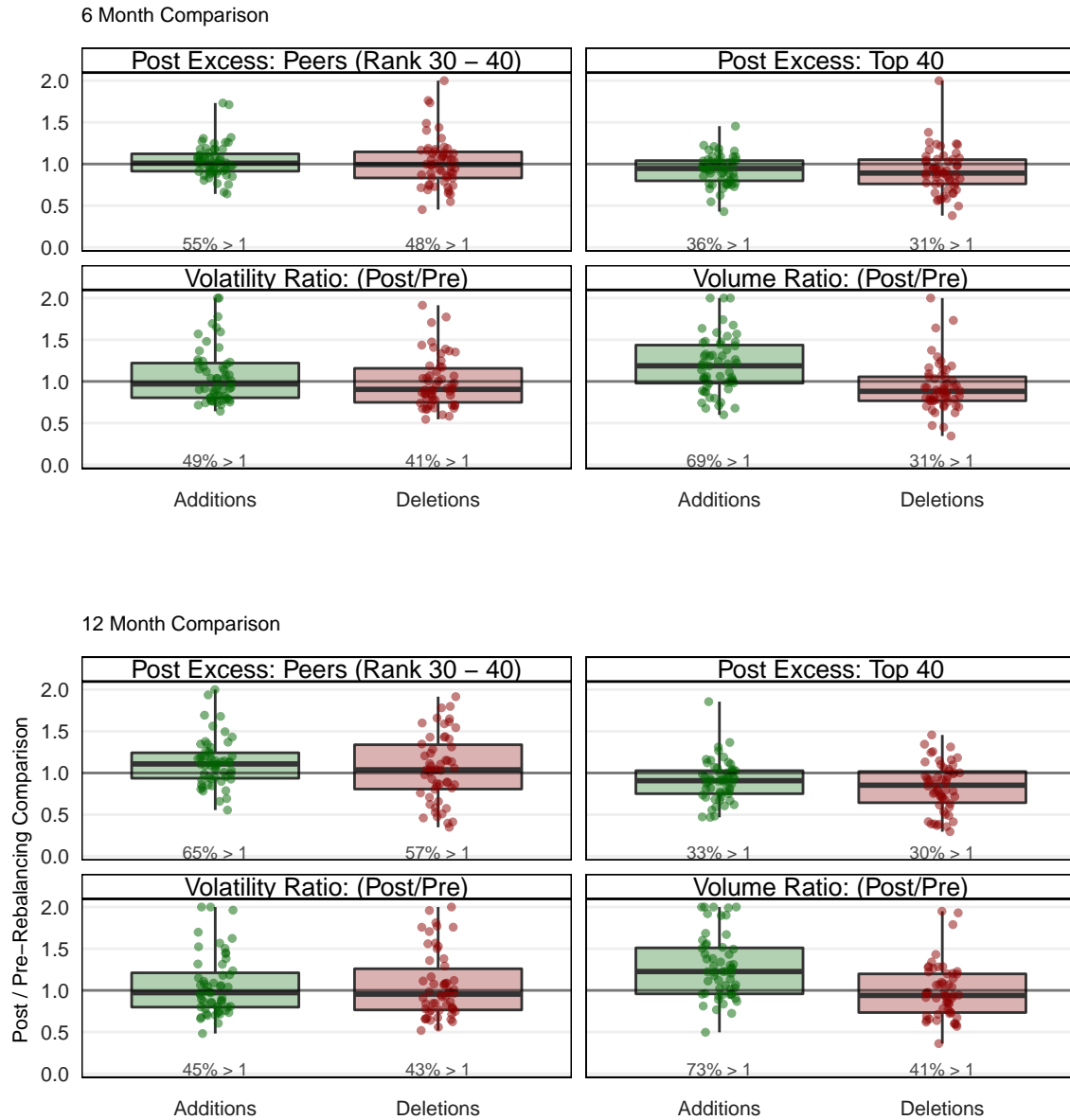
Figure 11: *Pre-/Post Return Comparison: 6 and 12 Months*

From Figure 11 above, we make the following conclusions. First, there is no clear post-excess return benefit to additions either relative to size peers or the Top 40 Index. Thus the post-inclusion glow (post-exclusion depression) found by several authors listed before does not generally apply to the Top 40. In fact, on a twelve month basis both additions and deletions tend to underperform the Top 40, which could (at least partly) be explained by a comparative size effect. This is confirmed by comparable returns relative to size peers. We thus do not find any reason to be particularly positive about additions over a 6 or 12 month basis as a result of entering the index. Also

important to consider is the second moment, or the relative volatility. The third set of figures show that there is no clear and consistent change in the volatility of additions or deletions relative to their own past following rebalancing.

The only clear change in the stocks' fortunes are in terms of their liquidity. We find that additions experience a consistent and significant rise in volume traded (typically up more than 25% after entering the Top 40), while deletions experience a relative decline in volume traded. The depression in trade for deletions is more muted than the increase for additions, particularly over a twelve month horizon.

In summary, it seems as though there exists little evidence of a medium to longer term upward (downward) correction in prices for additions (deletions), while volatilities remain largely unchanged on aggregate. The only lasting impact following inclusion or exclusion from the Top 40 is a change in volumes traded, particularly for additions.

8. Conclusion

The aim of this paper is to understand what the impact of index rebalancing is on entering or exiting stocks. First, we test whether there exists a significant and predictable price distortion following the simultaneous trading of passive index providers on the rebalancing date (RD). We consider the trading days surrounding the effective RD, and find (counter-intuitively) that additions (deletions) face lower (higher) returns on the RD. This is despite a large and predictable spike in volume traded for said stocks, largely as a result of passives being forced to buy and sell these constituents.

We then discuss some theories and literature that explain the possible existence and explanation of an Index Effect, and show evidence of the same. The evidence is generally only clear for the long-short trading signal after the JSE moved the rank-cut (or constituent calculation) date back to 19 trading days before the RD. This implies that fund managers with the capacity to take short positions, could earn profitable returns, provided they have the ability to accurately predict additions and deletions. Interestingly, though, this strategy should ideally be closed a few days before official rebalancing, likely as a result of over-shot index front-running.

Our last contribution is to consider a medium to longer term view on a possible Index Effect. We show that the returns distribution of both stocks entering and exiting the Index tend to be lower than the benchmark for the 6 and 12 months after rebalancing. It is, however, more in line with other size peer (rank 30 - 40) return profiles over these periods. We also find that volatilities remain comparable after the RD. Stocks entering and exiting the index do, however, face significantly higher (lower) levels of volume traded.

9. Appendix

9.1. Wilcoxon test

The Wilcoxon rank sum test is a non-parametric alternative to the widely used t-statistic, based on the order in which two samples rank. In similar spirit to its parametric counterpart, it compares the medians of two distributions. This test makes no assumptions about the distribution of the data; it is only sensitive to changes in the median. The null hypothesis under this test is that the median difference between the pairs are zero. Constructing the test statistic involves computing the difference for each pair i and storing the absolute difference, d_i, and the sign of that difference, S_i. Then the absolute differences, d_i, are sorted from small to large and a rank is attached to each observation. If the rank is denoted by R_i, the test statistic is defined as follows:

$$W = |\sum_i S_i R_i| \tag{9.1}$$

Where W will be distributed approximately normal for n > 10. Intuitively, if the difference between medians is zero, W = 0, which entails that half of the signs are positive and half are negative and the sign would therefore be unrelated to rank.

9.2. List of Additions and Deletions

Table 1: *List of Additions*

Date	Tickers	Weekday	Company
23-December-2002	AVG	Monday	AVGOLD LTD
24-March-2003	NPN	Monday	NASPERS LTD-N
23-June-2003	WHL	Monday	WOOLWORTHS HLDGS
20-September-2004	ECO	Monday	EDGARS CONS STOR
20-March-2006	AXL	Monday	AFRICAN PHOENIX
26-September-2006	RLO	Tuesday	REUNERT LTD
27-December-2006	LON	Wednesday	LONMIN PLC
19-March-2007	ARI	Monday	AFRICAN RAINBOW
19-March-2007	WHL	Monday	WOOLWORTHS HLDGS
24-December-2007	AEG	Monday	AVENG LTD
25-March-2008	AXL	Tuesday	AFRICAN PHOENIX
22-September-2008	SHP	Monday	SHOPRITE HLDGS
22-December-2008	GRT	Monday	GROWTHPOINT PROP
22-December-2008	PIK	Monday	PICK'N PAY STORE
23-March-2009	APN	Monday	ASPEN PHARMACARE
23-March-2009	DSY	Monday	DISCOVERY LTD
21-September-2009	SNH	Monday	STEINHOFF INT NV
23-March-2010	MND	Tuesday	MONDI LTD
23-March-2010	MNP	Tuesday	MONDI PLC
21-June-2010	MSM	Monday	MASSMART HLDGS
21-June-2010	TRU	Monday	TRUWORTHS INTL
20-June-2011	ASR	Monday	ASSORE LTD
19-September-2011	WHL	Monday	WOOLWORTHS HLDGS

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Table 1 – *Continued from previous page*

19-December-2011	BTI	Monday	BRIT AMER TOBACC
25-June-2012	IPL	Monday	IMPERIAL LOGISTI
25-September-2012	MRP	Tuesday	MR PRICE GROUP
24-December-2012	MDC	Monday	MEDICLINIC INT
25-March-2013	DSY	Monday	DISCOVERY LTD
23-December-2013	CCO	Monday	CAPITAL & COUNTI
23-December-2013	LHC	Monday	LIFE HEALTHCARE
24-March-2014	REI	Monday	REINET INVEST-DR
22-September-2014	MRP	Monday	MR PRICE GROUP
22-December-2014	NTC	Monday	NETCARE LTD
22-December-2014	RMI	Monday	RAND MERCHANT IN
22-June-2015	BAT	Monday	BRAIT SE
22-June-2015	CPI	Monday	CAPITEC BANK HOL
22-June-2015	MMI	Monday	MMI HOLDINGS LTD
21-September-2015	RDF	Monday	REDEFINE PROPERT
21-December-2015	FFA	Monday	FORTRESS REIT A
21-December-2015	FFB	Monday	FORTRESS REIT B
21-December-2015	PSG	Monday	PSG GROUP LTD
22-March-2016	ANG	Tuesday	ANGLOGOLD ASHANT
19-September-2016	BVT	Monday	BIDVEST GROUP
19-September-2016	GFI	Monday	GOLD FIELDS LTD
19-September-2016	LHC	Monday	LIFE HEALTHCARE
19-September-2016	SGL	Monday	SIBANYE GOLD LTD
19-December-2016	SAP	Monday	SAPPI LTD
20-March-2017	TRU	Monday	TRUWORTHS INTL
19-June-2017	CPI	Monday	CAPITEC BANK HOL
18-September-2017	NRP	Monday	NEPI ROCKCASTLE
18-December-2017	RES	Monday	RESILIENT REIT L
19-March-2018	IPL	Monday	IMPERIAL LOGISTI
19-March-2018	SPP	Monday	SPAR GRP LTD/THE
19-March-2018	TFG	Monday	TFG
19-March-2018	TRU	Monday	TRUWORTHS INTL

Table 2: *List of Deletions*

Date	Tickers	Weekday	Company
20-December-2002	CRH	Friday	CORONATION HLDGS
20-March-2003	0861674D	Thursday	ALEXANDER F EARLIER
20-June-2003	DRD	Friday	DRDGOLD LTD
17-September-2004	DSY	Friday	DISCOVERY LTD
17-March-2006	NPK	Friday	NAMPAK LTD
22-September-2006	WHL	Friday	WOOLWORTHS HLDGS
22-December-2006	JDG	Friday	JD GROUP LTD
16-March-2007	AXL	Friday	AFRICAN PHOENIX
16-March-2007	RLO	Friday	REUNERT LTD
21-December-2007	WHL	Friday	WOOLWORTHS HLDGS
20-March-2008	IPL	Thursday	IMPERIAL LOGISTI
19-September-2008	BAW	Friday	BARLOWORLD LTD
19-December-2008	AEG	Friday	AVENG LTD

Table 2 – *Continued from previous page*

|			
19-December-2008	MUR	Friday	MURRAY & ROBERTS
20-March-2009	MND	Friday	MONDI LTD
20-March-2009	SAP	Friday	SAPPI LTD
18-September-2009	DSY	Friday	DISCOVERY LTD
19-March-2010	TKG	Friday	TELKOM SA SOC LT
18-June-2010	LBH	Friday	LIBERTY HLDGS
18-June-2010	PPC	Friday	PPC LTD
17-June-2011	PIK	Friday	PICK'N PAY STORE
16-September-2011	REI	Friday	REINET INVEST-DR
15-December-2011	ACL	Thursday	ARCELORMITTAL SO
22-June-2012	LON	Friday	LONMIN PLC
21-September-2012	AXL	Friday	AFRICAN PHOENIX
21-December-2012	HAR	Friday	HARMONY GOLD MNG
22-March-2013	MRP	Friday	MR PRICE GROUP
20-December-2013	GFI	Friday	GOLD FIELDS LTD
20-December-2013	MSM	Friday	MASSMART HLDGS
20-March-2014	TRU	Thursday	TRUWORTHS INTL
19-September-2014	ARI	Friday	AFRICAN RAINBOW
19-December-2014	ASR	Friday	ASSORE LTD
19-December-2014	EXX	Friday	EXXARO RESOURCES
19-June-2015	IMP	Friday	IMPALA PLATINUM
19-June-2015	IPL	Friday	IMPERIAL LOGISTI
19-June-2015	LHC	Friday	LIFE HEALTHCARE
18-September-2015	KIO	Friday	KUMBA IRON ORE L
18-December-2015	ANG	Friday	ANGLOGOLD ASHANT
18-December-2015	MMI	Friday	MMI HOLDINGS LTD
18-March-2016	PSG	Friday	PSG GROUP LTD
16-September-2016	AMS	Friday	ANGLO AMERICAN P
16-September-2016	CCO	Friday	CAPITAL & COUNTI
16-September-2016	CPI	Friday	CAPITEC BANK HOL
16-September-2016	RMI	Friday	RAND MERCHANT IN
15-December-2016	SGL	Thursday	SIBANYE GOLD LTD
17-March-2017	BAT	Friday	BRAIT SE
15-June-2017	IMP	Thursday	IMPALA PLATINUM
15-September-2017	TRU	Friday	TRUWORTHS INTL
15-December-2017	NTC	Friday	NETCARE LTD
16-March-2018	FFA	Friday	FORTRESS REIT A
16-March-2018	FFB	Friday	FORTRESS REIT B
16-March-2018	ITU	Friday	INTU PROPERTIES
16-March-2018	RES	Friday	RESILIENT REIT L
16-March-2018	SNH	Friday	STEINHOFF INT NV
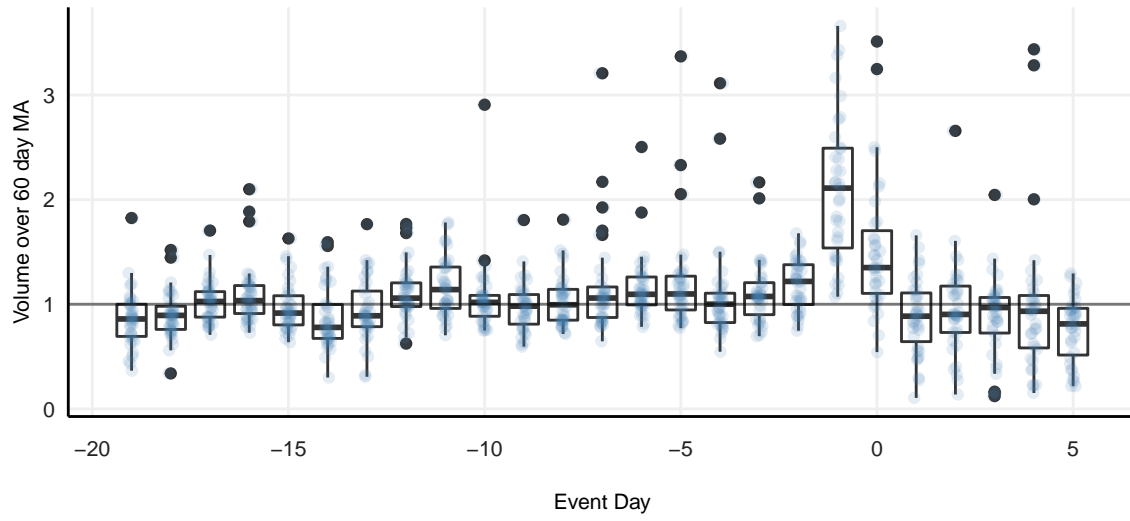
Figure 12: *FTSE/JSE Top 40 Index Daily Volume Relative to 60 Day Moving Average*

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